

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平10-146871

(43) 公開日 平成10年(1998) 6月2日

(51) Int.Cl.<sup>9</sup>  
B 2 9 C 45/54

識別記号

F I  
B 2 9 C 45/54

審査請求 有 請求項の数 4 O L (全 7 頁)

(21) 出願番号 特願平8-309730

(22) 出願日 平成8年(1996)11月20日

(71) 出願人 390004363

ツオイス株式会社

福島県安達郡本宮町大字高木字井戸上14番  
地1

(72) 発明者 柴田 徹

福島県安達郡本宮町大字高木字井戸上14番  
地1 ツオイス株式会社内

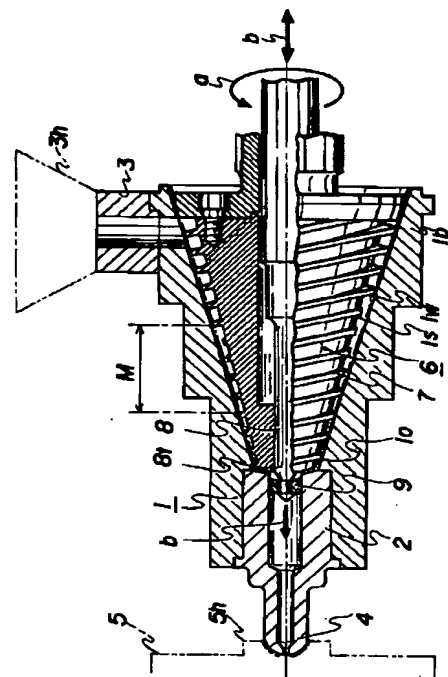
(74) 代理人 弁理士 水野 博文

(54) 【発明の名称】 可塑化混練装置

(57) 【要約】

【課題】直円錐形状スクリュの可塑化混練装置は、軟化初期段階で急速に粘度が上昇する樹脂を用いた場合には、原料の搬送過多が発生してスクリュの中間点付近でスクリュ溝内に詰まり、回転駆動装置のトルクオーバーになったり、搬送量の不均一化、あるいは搬送時間の不安定化が発生する場合があった。

【解決手段】直円錐形状スクリュの可塑化混練装置のバレルの内空室の内壁面のうち、供給口から送出口までの間の少なくとも中間部を鏡面仕上げとする。及び又は、前記中間部における前記バレル側周面に形成された直円錐形状のスクリュの螺旋凸条の頂部と内空室の内壁面との間隙量を、それ以外の部分の間隙量より大きくする。



BEST AVAILABLE COPY

### 【特許請求の範囲】

【請求項１】 先端縮径の直円錐形状の内空室が形成され、該内空室の後端周部に原料の供給口が形成され、かつ先端部に送出口が形成されたバレルと、  
該バレルの内空室内に略適合して嵌合し、同軸上で軸回転自在に保持されると共に、側周面に螺旋凸条が形成された直円錐形状のスクリュと、  
前記バレルの送出口と同軸上に接続され、その先端部にノズルが形成された射出シリンダと、  
前記スクリュ内の同軸上に摺動可能に組み込まれ、その先端部が前記射出シリンダ内を進退移動する射出プランジャと、  
からなる可塑性混練装置において、  
前記バレルの内空室の内壁面のうち、供給口から送出口までの間の少なくとも中間部を鏡面仕上げとしたことを特徴とする可塑性混練装置。

【請求項２】 先端縮径の直円錐形状の内空室が形成され、該内空室の後端周部に原料の供給口が形成され、かつ先端部に送出口が形成されたバレルと、  
該バレルの内空室内に略適合して嵌合し、同軸上で軸回転自在に保持されると共に、側周面に螺旋凸条が形成された直円錐形状のスクリュと、  
前記バレルの送出口と同軸上に接続され、その先端部にノズルが形成された射出シリンダと、  
前記スクリュ内の同軸上に摺動可能に組み込まれ、その先端部が前記射出シリンダ内を進退移動する射出プランジャと、  
からなる可塑性混練装置において、  
前記バレル内空室の供給口から送出口までの間の中間部における、前記螺旋凸条の頂部と内空室の内壁面との間隙量を、それ以外の部分の間隙量より大きくしたことを特徴とする可塑性混練装置。

【請求項3】 先端縮径の直円錐形状の内空室が形成され、該内空室の後端周部に原料の供給口が形成され、かつ先端部に送出口が形成されたバレルと、  
該バレルの内空室内に略適合して嵌合し、同軸上で軸回転自在に保持されると共に、側周面に螺旋凸条が形成された直円錐形状のスクリュと、  
前記バレルの送出口と同軸上に接続され、その先端部にノズルが形成された射出シリンダと、  
前記スクリュ内の同軸上に摺動可能に組み込まれ、その先端部が前記射出シリンダ内を進退移動する射出プランジャと、  
からなる可塑性混練装置において、  
前記バレルの内空室の内壁面のうち、供給口から送出口までの間の少なくとも中間部を鏡面仕上げとすると共に、  
前記バレル内空室の供給口から送出口までの間の中間部における、前記螺旋凸条の頂部と内空室の内壁面との間隙量を、それ以外の部分の間隙量より大きくしたことを特徴とする可塑性混練装置。

【請求項4】 先端縮径の直円錐形状の内空室が形成され、該内空室の後端周部に原料の供給口が形成され、か

つ先端部に送出口が形成されたバレルと、  
該バレルの内空室内に略適合して嵌合し、同軸上で軸回  
転自在に保持されると共に、側周面に螺旋凸条が形成さ  
れた直円錐形状のスクリュと、  
前記バレルの送出口と同軸上に接続され、その先端部に  
ノズルが形成された射出シリンダと、  
前記スクリュ内の同軸上に摺動可能に組み込まれ、その  
先端部が前記射出シリンダ内を進退移動する射出ブラン  
ジャと、からなる可塑性混練装置において、  
縮径勾配が一定である前記バレル内空室形のうち、供給  
口から送出口までの間の中間部を、拡張させたことを特  
徴する可塑性混練装置。

## 【発明の詳細な説明】

**【 0 0 0 1 】**

【発明の属する技術分野】本願発明は、射出成形、ブロー成形、又は押出成形における成形用樹脂原料の可塑化・混練・搬送を、バレルの内空室とこれに適合するスクリュを直円錐形状にすることを特徴とした可塑化混練装置の技術分野に属する。

【 0 0 0 2 】

【発明の前提と従来までの技術】従来の可塑化・混練・搬送装置のうち射出成形機に用いたものとしては、円柱形状のスクリュ内の同軸上に射出ブランジャを組み込んだ方式が存在していた（例えば、実用新案出願公開昭和63年第189618号、特許出願公開平成2年第164511号）。

【0003】かかる可塑化・射出機構50は、図7に示すように、主に次のような構成が採られていた。すなわち、外側周部には加熱手段としてのバンドヒータ51を備え、後方には原料（固形粒状化された樹脂）を供給するホッパー52が接続された、内空形円筒状のバレル53を構成し、そしてこのバレル53内には外周側面に螺旋溝54が形成されたスクリュ55を適合配置している。このスクリュ55は、回転駆動機構56によって、バレル中空形の同軸上で軸回転するように構成されている。

【0004】さらに、バレル53の先端側（反ホッパー52側）には、同軸上に連続するようにして射出シリンダ57が配置されており、かつその先端部にはノズル58が形成されている。

【0005】また、スクリュ55内の同軸上には、円柱棒状の射出プランジャ59が、摺動可能に組み込まれており、その先端部側は、スライド駆動機構（図示省略。）によって、スクリュ55の先端から露出して射出シリンダ57内へ進入又は退出（矢印c）するように構成されている。

【0006】上記構成により、ホッパー52から供給された原料は、順次スクリュ55の幹部側の螺旋溝54に巻き込まれて行き、その回転によって発生する分子剪断による摩擦熱、及びバンドヒータ51からの付加熱によ

って軟化溶融（可塑化）すると共に先端方向（前方）へ搬送されて行く。このようにして搬送された溶融材（原料）は、射出シリンダ57内に貯溜され、所定量に達したところで、一時スクリュ55の回転を停止させ、射出プランジャ59の働きによってノズル58から、キャビティ（成形用金型、図示省略。）内に射出させられるものである。

【0007】しかし、かかる機構では、スクリュ55が円柱状であるため、例えば、含油樹脂やポリアミド、ポリブチレンテレフタレート、ポリエチレンテレフタレート、などの粘性の小さい樹脂では、溶融樹脂が空転して前方への搬送不能（いわゆるスリップ現象）となる問題点が生じていた。

【0008】ところで、バレル内のスクリュ溝の回転による搬送力を確保するためには、

（溶融材とバレル内面壁との円周方向摩擦力「対バレル摩擦力 $T_b$ 」）＞（溶融材とスクリュ外周壁との円周方向摩擦力「対スクリュ摩擦力 $T_s$ 」）

の関係にある必要があり、対バレル摩擦力 $T_b$ は大きい程良く、逆に対スクリュ摩擦力 $T_s$ が小さい程、より大きな搬送力が得られると言える。

【0009】上記従来のバレル53とスクリュ55の構造では、搬送力（溶融材を前方へ押しやる力）の作用方向は、バレルの内面壁と平行であるため、その内面壁への垂直分力が発生し難かった。そのため、実際の両摩擦力 $T_b$ 、 $T_s$ には、差がなくなり、溶融材は同じ位置で空転した状態になっていた。例えて言うならば、ネジに螺合したナットが、そのナットの回転を抑える力がないため、その位置で空転してしまい、前方へ移動しなくなることには似ていた。

【0010】そのため、かかる機種では、バレル内面壁を粗く仕上げるのが定石であったが、それでも搬送不能を生じていた。上記問題点を解決するものとして、本願出願人は、バレル内空室とこれに適合して嵌合するスクリュの形状を直円錐形状とした画期的な可塑化混練装置を射出成形機の可塑化・射出機構に応用して、既に特公平7-75859号、特願平7-232353号として提供開示している。

【0011】なお、この可塑化・射出機構の主な構成は、後述の実施例の中であわせて説明して行く。

【0012】

【発明が解決しようとする課題】しかし、上記直円錐形状スクリュの可塑化混練装置は、それより以前の直棒状スクリュのものにあった搬送不能の欠点を効果的に解消するものであったが、軟化初期段階で急速に粘度が上昇する樹脂（例えば：PMMA樹脂、LCP樹脂やPBT樹脂）等、一部の種類の樹脂原料では、原料の搬送過多が発生してスクリュの中間点付近でスクリュ溝内に詰まってしまう、回転駆動装置のトルクオーバーになったり、搬送量の不均一化、あるいは搬送時間の不安定化が発生

する場合があった。

【0013】

【目的】そこで、本願発明は、かかる先出願の優れた特徴を残しつつ、これらの不都合な点に着目し、さらなる改良を施すことにより、原料樹脂の搬送過多を防止すると共に、安定した搬送を行わせることを目的とした新規な可塑化混練装置を提供するものである。

【0014】

【課題を解決するための手段】本願発明に係る可塑化混練装置は以下のように構成されている。すなわち、先端縮径の直円錐形状の内空室が形成され、該内空室の後端周部に原料の供給口が形成され、かつ先端部に送出口が形成されたバレルと、該バレルの内空室内に略適合して嵌合し、同軸上で軸回転自在に保持されると共に、側周面に螺旋凸条が形成された直円錐形状のスクリュと、前記バレルの送出口と同軸上に接続され、その先端部にノズルが形成された射出シリンダと、前記スクリュ内の同軸上に摺動可能に組み込まれ、その先端部が前記射出シリンダ内を進退移動する射出プランジャと、からなる可塑化混練装置において、前記バレルの内空室の内壁面のうち、供給口から送出口までの間の少なくとも中間部を鏡面仕上げとしたことを特徴とする。

【0015】または、前記バレル内空室の供給口から送出口までの間の中間部における、前記螺旋凸条の頂部と内空室の内壁面との間隙量を、それ以外の部分の間隙量より大きくしたことを特徴とする。

【0016】さらに、前記バレルの内空室の内壁面のうち、供給口から送出口までの間の少なくとも中間部を鏡面仕上げとすると共に、前記バレル内空室の供給口から送出口までの間の中間部における、前記螺旋凸条の頂部と内空室の内壁面との間隙量を、それ以外の部分の間隙量より大きくすることも可能である。

【0017】あるいは、直円錐形状に形成されて縮径勾配が一定となる前記バレル内空室形のうち、供給口から送出口までの間の中間部を、拡張させてもよい。

【0018】

【作用】以上の構成により、本願発明は、バレルの内空室の内面壁の少なくとも中間部を鏡面仕上げとすることで、短軸で搬送力が十分に確保された円錐形状のスクリュにおいて、樹脂原料の種類によっては問題となっていた搬送過多が解消され、軟化又は溶解した状態の樹脂の搬送が安定確実に行われる。

【0019】また、スクリュの螺旋凸条の少なくとも中間部の頂部の高さを、他の部分より低くすることにより、頂部と内壁面との間隙を大きく採ることで、軟化又は溶解した原料を積極的に乗り越えさせて移動させる。これにより、過剰な搬送によるスクリュと内壁面との間への原料詰まりが解消され、これによるスクリュのトルクオーバー（過負荷）が防止される。

【0020】さらに、これら内面壁の鏡面仕上げと、ス

クリュの螺旋凸状頂部の一部又は全部削除とを組み合わせることにより、種々の樹脂原料（軟化による粘度勾配の大きい樹脂）に的確に対応することとなる。

#### 【0021】

【発明の実施の形態】次に、上記のように構成する本願発明の具体的実施の一例について、図面に基づいて詳細に説明する。図1は本実施例の全体を示す切欠き縦断面図であり、図2はその要部を拡大して示す縦断面図である。

【0022】バレル1は、その内部に先端方向（図面上、左側）に向かって縮径された回転体形である円錐形状（別称「直円錐形状」）をもった内空室1sを形成しており、その先端の送出口1oで内空室1sと連通する射出シリンダ2が同軸上に連結固定されている。また、内空室1sの後端側部1bには、内空室1sに連通して樹脂材やセラミック粉体又は金属粉体などの混合材などからなる、固形粒状化された原料を供給するための供給口3を形成している。この供給口3には、通常ロート状のホッパ3hを連結している。

【0023】このバレル1の内壁面1wは、上述したように搬送力を確保するため通常粗く仕上げられているのが定石であるが、本願発明では、円錐形状の内空室1sとしているため、後述するように、その形状から必要かつ十分な搬送力が確保されている。そこで、本願発明の主眼は、この搬送力を安定したものとするため、内壁面1wの仕上げを、従来の定石に反して鏡面仕上げとすることにある。この鏡面仕上げとする範囲は、内壁面1sの全面としてもよいが、本実施例では、供給口3から送出口1oまでの間の少なくとも中間部Mを鏡面仕上げとしている。具体的には、スクリュ6の先端と後端の螺旋凸状7の3～4巻き分を残した部分に対応した内壁面1sをバフ研磨し、好ましくは $Ra$ （中心線平均粗さ）＝ $8\mu m$ 以下となるようにする。

【0024】なお、この鏡面仕上げの程度は、使用する樹脂原料の種類によって適宜設定されるもので、この中間部Mの面状態を他の部分と比較して、より平滑な面に仕上げをすることを意味するものである。また、この鏡面仕上げをする部分は、中間部Mに限定するものではなく、「少なくとも」の語句から、中間部Mの他に、先端付近又は後端付近を口5hと結合するものである。

【0025】スクリュ6は、上記バレル1の内空室1sに略適合する直円錐形状に形成してバレル内空室1sに配置し、軸回転（矢印a）可能に保持すると共に、その後端部には回転駆動機構（図示省略。）が連結されている。また側周面には、先端へ向かって螺旋状に巻回された螺旋凸条7を形成しており、その頂部7pは内空室1sの内壁面1wに略近接するように配置される。

【0026】そして、本願発明の特徴として、この螺旋凸条7は、供給口3から送出口1oまでの間の中間部M、すなわちスクリュ6の先端と後端の螺旋凸状7の3

～4巻き分を残した部分の頂部7pの高さ $H_m$ を、それ以外の部分の頂部7pの高さ $H_o$ に比べ、低く形成している。別言すると、この中間部Mにおける螺旋凸条7の頂部7pと、内空室1sの内壁面1wとの間隙量 $CL_m$ を、それ以外の部分の間隙量 $CL_o$ より大きくなるように形成している。

【0027】この中間部Mにおける頂部7pの高さ $H_m$ の設定は、螺旋凸条7を好ましくは20～100%の範囲で削除することにより行われる。図1は、略50%を削除した状態であり、図3はその場合のスクリュ6の外観形状を示す斜視図である。

【0028】また図4は100%の削除を行った場合を示し、図5はその場合のスクリュ6の外観形状を示す斜視図である。この場合、中間部Mのスクリュ6の側周面は平滑な面となる。

【0029】次に、スクリュ6内には、従来と同様、その同軸上に射出プランジャ8を、摺動自在に組み込んでいる。この射出プランジャ8は、スライド駆動機構（図示省略。）によって、スクリュ6の先端部から露出して前記射出シリンダ2内を進退移動（矢印b）が可能となるように構成している。さらに、その先端部8tには、射出時の樹脂の逆流を防止するための、逆流防止弁9を取り付けている。なお、この逆流防止弁9は、通常一般的に用いられている機構のものであるため、その詳細な構成の説明は省略する。

【0030】また、上述の回転駆動機構、及びスライド駆動機構は、既に公知の一般的な駆動機構であるため、その詳細は省略する。

#### 【0031】

【本実施例の作用】かかる構成により本実施例は、以下のように作用する。直円錐形状に形成された内空室1s及びスクリュ6の母線Pは回転軸Cに対して一定の傾斜角 $\theta$ をもつため、図2の作図で示すように、螺旋凸条7の回転移動によって生じる回転軸Cと平行な作用力Fの分力として、壁面1wに垂直な抗力Nが作用する。この抗力Nと内壁面1wの摩擦係数 $\mu$ との積が、前記の対バレル摩擦力 $T_b$ （ $=\mu N$ ）となる。

【0032】このことは、上述した（対バレル摩擦力 $T_b$ ）>（対スクリュ摩擦力 $T_s$ ）関係において、対バレル摩擦力 $T_b$ は大きい程良いとの理論に密接に関係し、原料の搬送力の増減に影響するものである。

【0033】ここで、内壁面1wの鏡面仕上げされた中間部分Mでは、摩擦係数 $\mu$ が小さく、対バレル摩擦力 $T_b$ は比較的小さく押さえられる。この結果、熔融（又は軟化）原料と内壁面1wの間にはある程度のスリップが生じ、この部分における原料の搬送速度は、中間部分M以外の部分より比較的に遅くなることになる。

【0034】また、螺旋凸条7の頂部7Pが削除された部分では、この山部7Pを原料が乗り越えて移動する（矢印d）ことが可能となるため、過剰に搬送された原

10

20

30

40

50

料は、詰まることなく押し戻され、結果として原料の前方への搬送速度は遅延させられることになるものである。

#### 【0035】

【他の実施例】次に、図6は、他の実施例の全体を示す切欠き縦断面図である。この実施例は、直円錐形状に形成されて縮径勾配（軸方向を基準とした直径の収縮割合）が一定にされた前記バレル内空室のうち、供給口3から送出口10までの間の中間部Mを、若干量拡張させて内面壁1wを形成したものである。本実施例では、後端から一定の割合で縮径されたバレル内空室1sの内径を、中間部Mにおいて漸次拡張した後、漸次縮径して元の縮径勾配に戻す構成により、この拡張部1kを形成している。

【0036】かかる構成により、中間部Mにおけるスクリュ6の螺旋凸状7と内面壁1wとの間の間隙量が、それ以外の部分より広がることにより、熔融原料の移動、または対流が起き、結果として搬送を遅らせることになる。

【0037】なお、この拡張部1kの形状は、上記実施例（縦断面において三角形形状）に限定するものではなく、中間部Mの内径が、それ以外の部分の一定縮径勾配に反して若干量拡張するように構成するものであれば、三角形形状以外に例えば半円形状としても良い。

#### 【0038】

【他の実施例の可能性】なお、上記実施例において用いた、バレル1の内空室1sとこれに適合するスクリュ6の形状を直円錐形状のテーパ角（ $2\theta$ ）は、一種類に設定しているが、このテーパ角を二種類以上で組み合わせたことを内容とする先の出願（特願平7-232353号）で開示提供しているスクリュ形及び内空室形を、使用するようにしてもよい。これにより、種々の原料に的確に対応させることができることになる。

【0039】また、上記実施例では、本願発明の可塑化混練装置を射出成形機の可塑化・射出装置に適用した場合について述べているが、本願装置はこれに限定するものではなく、ブロー成形機の押出機に適用するなど、固形粒状の樹脂原料（又は樹脂混入原料）を軟化・熔融・混練させて前方へ送り出す装置に広く適用できる汎用性のあるものである。

#### 【0040】

【効果】上記本願発明の構成により、バレルの内空室の内面壁の少なくとも中間部を鏡面仕上げとすることにより、短軸で搬送力が十分に確保された円錐形状のスクリ

ュにおいて、樹脂原料の種類によっては問題となっていた搬送過多を解消することができ、軟化又は溶解した状態の樹脂の搬送を安定確実に行うことができる。

【0041】また、スクリュの螺旋凸状の頂部の高さを調整することにより、軟化又は溶解した原料を積極的に乗り越えさせて移動させることより、搬送過多によりスクリュと内壁面との間への原料詰まりによるスクリュのトルクオーバ（過負荷）を防止することができる。

【0042】さらに、これら内面壁の鏡面仕上げと、スクリュの螺旋凸状頂部の一部又は全部削除したものとを組み合わせることにより、種々の樹脂原料（軟化による粘度勾配の大きい樹脂）に的確に対応させることができる。

#### 【図面の簡単な説明】

【図1】 本実施例の全体を示す切欠き縦断面図である。

【図2】 本実施例の要部を拡大して示す縦断面図である。

【図3】 本実施例のスクリュの外観形状を示す斜視図である。

【図4】 他の実施例の全体を示す切欠き縦断面図である。

【図5】 他の実施例のスクリュの外観形状を示す斜視図である。

【図6】 他の実施例の全体を示す切欠き縦断面図である。

【図7】 従来例を示す切欠き縦断面図である。

#### 【符号の説明】

1・・・バレル

2・・・射出シリンダ

3・・・供給口

4・・・ノズル

5・・・金型

6・・・スクリュ

7・・・螺旋凸条

8・・・射出プランジャ

M・・・中間部（スクリュの～）

Hm・・・高さ（中間部の頂部の～）

Ho・・・高さ（中間部以外の頂部の～）

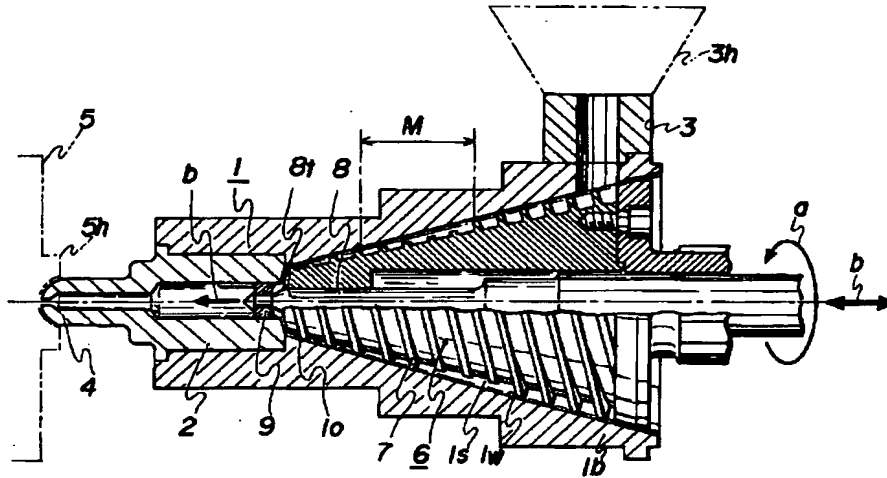
CLm・・・間隙量（中間部の～）

CLo・・・間隙量（中間部以外の～）

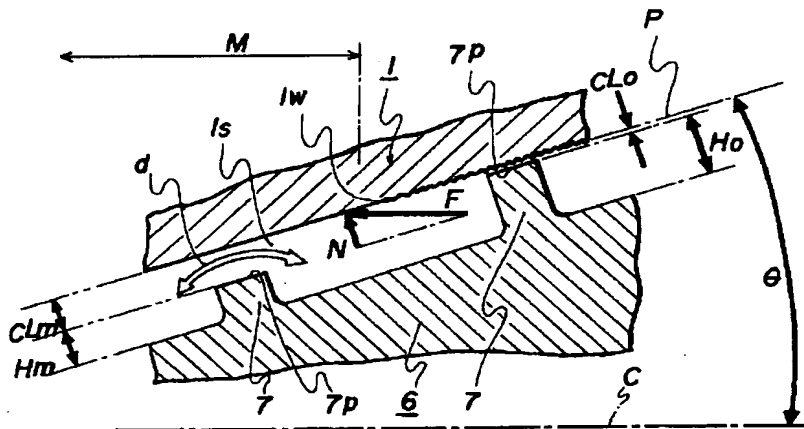
C・・・回転軸（スクリュの～）

P・・・母線（内空室の～）

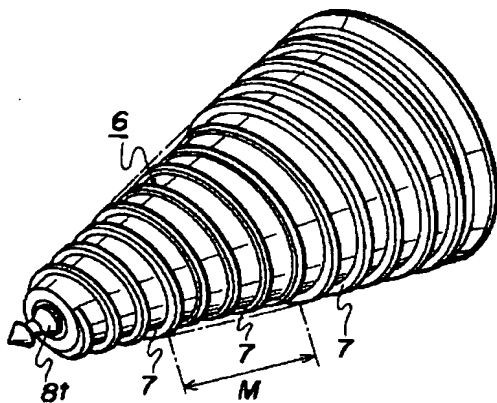
【図1】



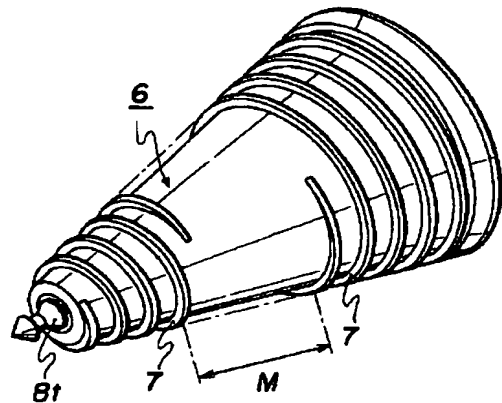
【図2】



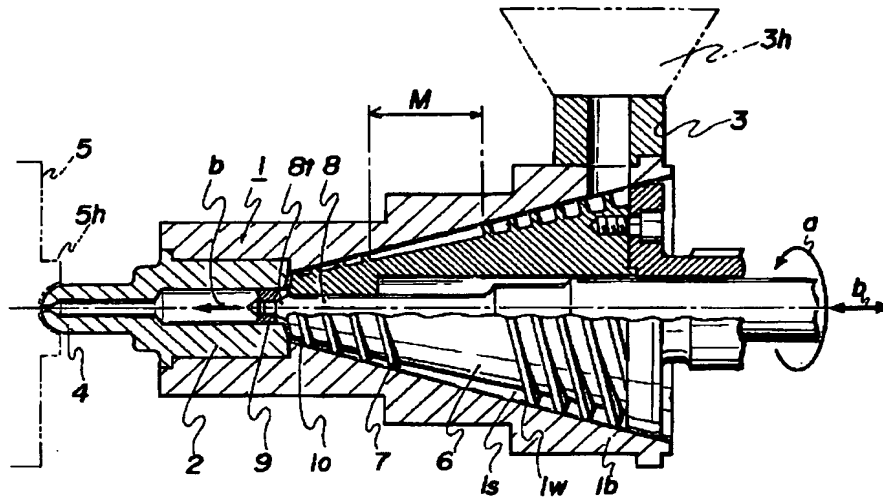
【図3】



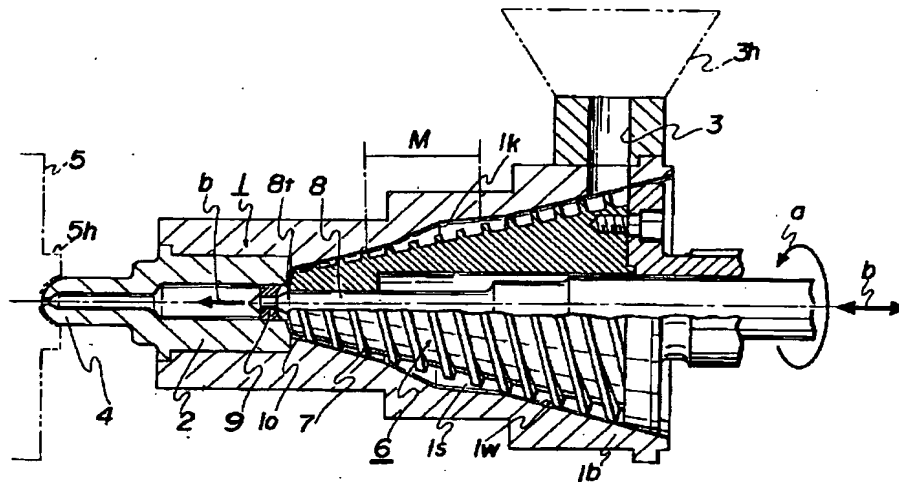
【図5】



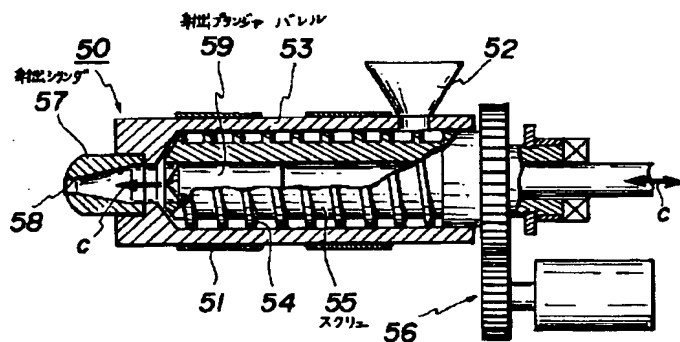
【図4】



【図6】



【図7】



## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-146871

(43)Date of publication of application : 02.06.1998

(51)Int.Cl.

B29C 45/54

(21)Application number : 08-309730

(71)Applicant : TSUOISU KK

(22)Date of filing : 20.11.1996

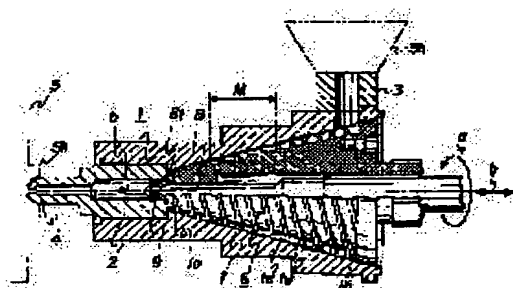
(72)Inventor : SHIBATA TORU

## (54) KNEADING EQUIPMENT FOR PLASTICIZATION

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To prevent an excess carriage of material resin and to conduct stable carriage by a method wherein at least the middle part of an inner wall surface of an internal hollow chamber of a barrel between a supply port and a delivery port is finished to be specular.

**SOLUTION:** A right-cone-shaped internal hollow chamber is formed in a barrel 1 and an injection cylinder 2 is fixed at a delivery port 1o in the fore end thereof, while a supply port 3 is formed in a part 1b on the rear end side of the internal hollow chamber is. At least the middle part M of an inner wall surface 1w of the barrel 1 between the supply port 3 and the delivery port 1o is finished to be specular. In other words, the inner wall surface 1w corresponding to a part except three to four turns of a helical projecting thread 7 in the fore and rear ends of a screw 6 is buffed so that central-line average roughness =  $8\mu\text{m}$  or below be obtained preferably. The degree of the specular finish is set according to the kind of a resin material to be used. In the middle part M, consequently, the coefficient  $\mu$  of friction becomes small, the speed of carriage of the material becomes low relatively and thus excessive carriage is prevented.



## LEGAL STATUS

[Date of request for examination] 20.11.1996

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 2927745

[Date of registration] 14.05.1999

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

BEST AVAILABLE COPY



# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-146871

(43)Date of publication of application : 02.06.1998

(51)Int.Cl.

B29C 45/54

(21)Application number : 08-309730

(71)Applicant : TSUOISU KK

(22)Date of filing : 20.11.1996

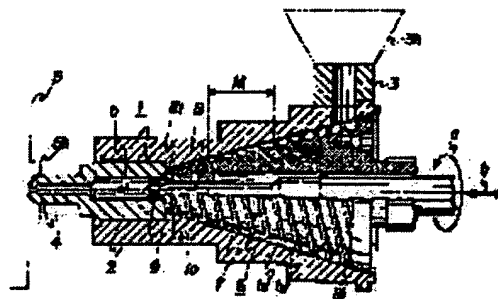
(72)Inventor : SHIBATA TORU

## (54) KNEADING EQUIPMENT FOR PLASTICIZATION

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To prevent an excess carriage of material resin and to conduct stable carriage by a method wherein at least the middle part of an inner wall surface of an internal hollow chamber of a barrel between a supply port and a delivery port is finished to be specular.

**SOLUTION:** A right-cone-shaped internal hollow chamber is formed in a barrel 1 and an injection cylinder 2 is fixed at a delivery port 1o in the fore end thereof, while a supply port 3 is formed in a part 1b on the rear end side of the internal hollow chamber is. At least the middle part M of an inner wall surface 1w of the barrel 1 between the supply port 3 and the delivery port 1o is finished to be specular. In other words, the inner wall surface 1w corresponding to a part except three to four turns of a helical projecting thread 7 in the fore and rear ends of a screw 6 is buffed so that central-line average roughness =  $8\mu\text{m}$  or below be obtained preferably. The degree of the specular finish is set according to the kind of a resin material to be used. In the middle part M, consequently, the coefficient  $\mu$  of friction becomes small, the speed of carriage of the material becomes low relatively and thus excessive carriage is prevented.



## LEGAL STATUS

[Date of request for examination]	20.11.1996
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	2927745
[Date of registration]	14.05.1999
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

CLAIMS

---

[Claim(s)]

[Claim 1] While carrying out abbreviation adaptation, fitting in in a vacant room among the barrel by which the inner vacant room of the right circular cone configuration of tip diameter reduction was formed, and the feed hopper of a raw material was formed in the back end periphery of this inner vacant room, and sending-out opening was formed in the point, and this barrel and being held free [ axial rotation ] on the same axle The screw of the right circular cone configuration by which the spiral protruding line was formed in the side peripheral surface, and the injection cylinder by which connected with sending-out opening of said barrel on the same axle, and the nozzle was formed in the point, In the becoming plasticization kneading equipment the injection plunger to which it is incorporated possible [ sliding on the same axle in said screw ], and the point carries out attitude migration of the inside of said injection cylinder -- since -- Plasticization kneading equipment characterized by the thing of a before [ from a feed hopper / sending-out opening ] for which pars intermedia was considered as mirror plane finishing at least among the internal surfaces of the inner vacant room of said barrel.

[Claim 2] While carrying out abbreviation adaptation, fitting in in a vacant room among the barrel by which the inner vacant room of the right circular cone configuration of tip diameter reduction was formed, and the feed hopper of a raw material was formed in the back end periphery of this inner vacant room, and sending-out opening was formed in the point, and this barrel and being held free [ axial rotation ] on the same axle The screw of the right circular cone configuration by which the spiral protruding line was formed in the side peripheral surface, and the injection cylinder by which connected with sending-out opening of said barrel on the same axle, and the nozzle was formed in the point, In the becoming plasticization kneading equipment the injection plunger to which it is incorporated possible [ sliding on the same axle in said screw ], and the point carries out attitude migration of the inside of said injection cylinder -- since -- Plasticization kneading equipment characterized by making volume of void of the crowning of said spiral protruding line and the internal surface of an inner vacant room in the pars intermedia of a before [ from the feed hopper of the vacant room in said barrel / sending-out opening ] larger than the volume of void of the other part.

[Claim 3] While carrying out abbreviation adaptation, fitting in in a vacant room among the barrel by which the inner vacant room of the right circular cone configuration of tip diameter reduction was formed, and the feed hopper of a raw material was formed in the back end periphery of this inner vacant room, and sending-out opening was formed in the point, and this barrel and being held free [ axial rotation ] on the same axle The screw of the right circular cone configuration by which the spiral protruding line was formed in the side peripheral surface, and the injection cylinder by which connected with sending-out opening of said barrel on the same axle, and the nozzle was formed in the point, In the becoming plasticization kneading equipment the injection plunger to which it is incorporated possible [ sliding on the same axle in said screw ], and the point carries out attitude migration of the inside of said injection cylinder -- since -- While being a feed hopper to sending-out opening among the internal surfaces of the inner vacant room of said barrel and considering pars intermedia as mirror plane finishing at least Plasticization kneading equipment characterized by making volume of void of the

crowning of said spiral protruding line and the internal surface of an inner vacant room in the pars intermedia of a before [ from the feed hopper of the vacant room in said barrel / sending-out opening ] larger than the volume of void of the other part.

[Claim 4] While carrying out abbreviation adaptation, fitting in in a vacant room among the barrel by which the inner vacant room of the right circular cone configuration of tip diameter reduction was formed, and the feed hopper of a raw material was formed in the back end periphery of this inner vacant room, and sending-out opening was formed in the point, and this barrel and being held free [ axial rotation ] on the same axle The screw of the right circular cone configuration by which the spiral protruding line was formed in the side peripheral surface, and the injection cylinder by which connected with sending-out opening of said barrel on the same axle, and the nozzle was formed in the point, In the becoming plasticization kneading equipment the injection plunger to which it is incorporated possible [ sliding on the same axle in said screw ], and the point carries out attitude migration of the inside of said injection cylinder -- since -- Plasticization kneading equipment with which diameter reduction inclination carries out the description of having made the diameter of the pars intermedia of a before [ from a feed hopper / sending-out opening ] expand among said fixed vacant room forms in a barrel.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

DETAILED DESCRIPTION

---

[Detailed Description of the Invention]

[0001]

[Field of the Invention] The invention in this application belongs to the technical field of the plasticization kneading equipment characterized by making into a right circular cone configuration the screw which suits the inner vacant room of a barrel, and this in plasticization, kneading, and conveyance of the molding resin raw material in injection molding, blow formation, or extrusion molding.

[0002]

[The premise of invention, and the technique to the former] As what was used for the injection molding machine among conventional plasticization, kneading, and transport device, the method which incorporated the injection plunger on the same axle in a cylindrical shape-like screw existed (for example, 63 years [ of utility model application public presentation Showa ] No. 189618, patent application public presentation [ Heisei 2 ] No. 164511).

[0003] As this plasticization / injection device 50 was shown in drawing 7 , the mainly following configurations were taken. That is, the barrel 53 of the shape of an inner sky type cylinder to which the outside periphery was equipped with the band-shaped electric heater 51 as a heating means, and the hopper 52 which supplies back a raw material (resin by which solid granulation was carried out) was connected is constituted, and adaptation arrangement of the screw 55 by which the spiral slot 54 was formed in the periphery side face in this barrel 53 is carried out. This screw 55 is constituted by the rotation drive 56 so that axial rotation may be carried out on the same axle of a barrel hollow form.

[0004] Furthermore, as it continues on the same axle, the injection cylinder 57 is arranged at the tip side (anti-hopper 52 side) of a barrel 53, and the nozzle 58 is formed in the point.

[0005] Moreover, on the same axle in a screw 55, the cylinder rod-like injection plunger 59 is incorporated possible [ sliding ], and the point side is constituted so that it may expose from the tip of a screw 55 and may advance or leave into the injection cylinder 57 with a slide drive (illustration abbreviation.) (arrow head c).

[0006] By the above-mentioned configuration, the raw material supplied from the hopper 52 is involved in the spiral slot 54 by the side of the management of a screw 55 one by one, goes, and it is conveyed in the direction of a tip (front), and it goes while carrying out softening melting (plasticization) with the frictional heat by the molecule shear generated by the rotation, and the addition heat from a band-shaped electric heater 51. Thus, the conveyed melting material (raw material) is stored in the injection cylinder 57, and it stops rotation of a screw 55 temporarily and it is made to inject it in a cavity (a molding die, illustration abbreviation.) from a nozzle 58 in the place which reached the specified quantity by work of an injection plunger 59.

[0007] However, by this device, since the screw 55 was cylindrical, in the viscous small resin of oleo resin, a polyamide, BORIBUCHIREN terephthalate, polyethylene terephthalate, etc., the trouble which melting resin races and serves as conveyance impossible (the so-called slip phenomenon) to the front had arisen.

[0008] By the way, in order to secure the conveyance force by rotation of the screw slot in a barrel, it is

> (circumferential direction frictional force of melting material and a barrel inside wall "the pair barrel frictional force  $T_b$ ") (circumferential direction frictional force of melting material and a screw peripheral wall "the pair screw frictional force  $T_s$ ").

It is necessary to be in \*\*\*\*\*, and it can be said that the bigger conveyance force is acquired, so that the frictional force  $T_b$  for a barrel is so good that it is large and the frictional force  $T_s$  for a screw is conversely small.

[0009] With the above-mentioned conventional barrel 53 and the structure of a screw 55, since the operation direction of the conveyance force (force which pushes aside melting material to the front) was parallel to the inside wall of a barrel, the vertical component to a surface wall could not generate it easily. Therefore, the difference was lost to both the actual frictional force  $T_b$  and  $T_s$ , and melting material had changed into the condition of having raced in the same location. If it compares and said, since there would be no force in which the nut screwed in the screw suppresses rotation of the nut, it raced in the location and was like not moving to the front.

[0010] Therefore, although standard tactics finished the barrel inside wall coarsely from this model, conveyance impossible was still produced. As what solves the above-mentioned trouble, an applicant for this patent applies the epoch-making plasticization kneading equipment which made the configuration of the screw which suits and fits into the empty type in a barrel, and this the right circular cone configuration to plasticization / injection device of an injection molding machine, and has already done the offer indication as JP,7-75859,B and Japanese Patent Application No. No. 232353 [ seven to ].

[0011] In addition, in the below-mentioned example, the main configurations of this plasticization / injection device are united and explained, and go.

[0012]

[Problem(s) to be Solved by the Invention] However, although the plasticization kneading equipment of the above-mentioned right circular cone configuration screw canceled effectively the fault of the conveyance impossible which suited the thing of a former straight-rod shaped screw from it From the resin raw material of some classes, the resin (for example, -MMA resin, LCP resin and PBT resin) with which viscosity rises quickly by the softening initial stage The excess of conveyance of a raw material occurred and it was got blocked near the midpoint of a screw in screw Mizouchi, and it became the torque over of a rotation driving gear, and there was a case where ununiformity-izing of the amount of conveyances or destabilization of conveyance time amount occurred.

[0013]

[Objects of the Invention] Then, the invention in this application offers new plasticization kneading equipment aiming at making stable conveyance perform while preventing the excess of conveyance of raw material resin by performing further amelioration paying attention to these inconvenient points, leaving the description which was excellent in this point application.

[0014]

[Means for Solving the Problem] The plasticization kneading equipment concerning the invention in this application is constituted as follows. Namely, the barrel by which the inner vacant room of the right circular cone configuration of tip diameter reduction was formed, and the feed hopper of a raw material was formed in the back end periphery of this inner vacant room, and sending-out opening was formed in the point, While carrying out abbreviation adaptation, fitting in in a vacant room among these barrels and being held free [ axial rotation ] on the same axle The screw of the right circular cone configuration by which the spiral protruding line was formed in the side peripheral surface, and the injection cylinder by which connected with sending-out opening of said barrel on the same axle, and the nozzle was formed in the point, In the becoming plasticization kneading equipment the injection plunger to which it is incorporated possible [ sliding on the same axle in said screw ], and the point carries out attitude migration of the inside of said injection cylinder -- since -- It is characterized by the thing of a before [ from a feed hopper / sending-out opening ] for which pars intermedia was considered as mirror plane finishing at least among the internal surfaces of the inner vacant room of said barrel.

[0015] Or it is characterized by making volume of void of the crowning of said spiral protruding line and the internal surface of an inner vacant room in the pars intermedia of a before [ from the feed hopper

of the vacant room in said barrel / sending-out opening ] larger than the volume of void of the other part.

[0016] Furthermore, it is also possible among the internal surfaces of the inner vacant room of said barrel to make volume of void with the internal surface of the crowning of said spiral protruding line in the pars intermedia of a before [ from the feed hopper of the vacant room in said barrel / sending-out opening ] while considering pars intermedia as mirror plane finishing at least and inner vacant room of a before [ from a feed hopper / sending-out opening ] larger than the volume of void of the other part.

[0017] Or the diameter of the pars intermedia of a before [ from a feed hopper / sending-out opening ] may be made to expand among said vacant room forms in a barrel where it is formed in a right circular cone configuration, and diameter reduction inclination becomes fixed.

[0018]

[Function] The invention in this application is the thing of the inside wall of the inner vacant room of a barrel for which pars intermedia is consider as mirror plane finishing at least , the excess of conveyance from which the conveyance force had become a problem in the screw of the fully secured cone configuration depending on the class of resin raw material with the minor axis is cancel by the above configuration , and conveyance of the resin in the condition of having soften or dissolve is ensure stably .

[0019] Moreover, by [ of a screw / spiral convex ] making the height of the crowning of pars intermedia lower than other parts at least, by taking the gap of a crowning and an internal surface greatly, the raw material which became soft or dissolved is made to be overcome positively, and is moved. Raw material plugging of a between [ the screws and internal surfaces by superfluous conveyance ] is canceled by this, and the torque over (overload) of the screw by this is prevented.

[0020] Furthermore, a part of \*\* will correspond to various resin raw materials (large resin of the viscosity inclination by softening) exactly by [ of mirror plane finishing of these insides wall, and the spiral convex crowning of a screw ] all combining deletion.

[0021]

[Embodiment of the Invention] Next, an example of concrete operation of the invention in this application constituted as mentioned above is explained to a detail based on a drawing. Drawing 1 is notch drawing of longitudinal section showing whole this example, and drawing 2 is drawing of longitudinal section expanding and showing the important section.

[0022] A barrel 1 forms 1s of inner vacant rooms with the cone configuration (another name "a right circular cone configuration") which is the body-of-revolution form whose diameter was reduced by the interior toward the direction of a tip (a drawing top, left-hand side), and connection immobilization of the injection cylinder 2 which is open for free passage with 1s of inner vacant rooms by sending-out opening 1o at the tip is carried out on the same axle. Moreover, the feed hopper 3 for supplying the raw material by which solid granulation was carried out which is open for free passage to 1s of inner vacant rooms, and consists of admixtures, such as resin material, and ceramic powder or metal fine particles, etc. is formed in back end flank of 1s of inner vacant rooms 1b. this feed hopper 3 -- usually -- a funnel - hopper 3h of a \*\* is connected.

[0023] As mentioned above, in order that internal-surface 1w of this barrel 1 may secure the conveyance force, standard tactics are usually finished coarsely, but in the invention in this application, since it is considering as 1s of inner vacant rooms of a cone configuration, the need and sufficient conveyance force are secured from that configuration so that it may mention later. Then, since the chief aim of the invention in this application should be stabilized in this conveyance force, it is to consider finishing of internal-surface 1w as mirror plane finishing against the conventional standard tactics. Although the range considered as this mirror plane finishing is good also as the whole surface of 1s of internal surfaces, while being from a feed hopper 3 to sending-out opening 1o, by this example, pars intermedia M is considered as mirror plane finishing at least. concrete -- the spiral convex of the tip of a screw 6, and the back end -- buffing of the 1s of the internal surfaces corresponding to the part which left the 3-4-roll part of 7 is carried out, and it is made to become less than [ Ra(center line average of roughness height) =8micrometer ] preferably

[0024] In addition, extent of this mirror plane finishing means it being set up suitably and making a smoother field to the field condition of this pars intermedia M according to the class of resin raw material to be used, as compared with other parts. Moreover, the part which carries out this mirror plane finishing is not limited to pars intermedia M, and combines near a tip or near the back end with 5h of openings from the phrase of "even if few". [ other than pars intermedia M ]

[0025] While forming a screw 6 in 1s of inner vacant rooms of the above-mentioned barrel 1 at the right circular cone configuration which carries out abbreviation adaptation, arranging it to 1s of vacant rooms in a barrel and holding possible [ axial rotation (arrow head a) ], the rotation drive (illustration abbreviation.) is connected with the back end section. Moreover, the spiral protruding line 7 spirally wound toward the tip is formed in a side peripheral surface, and the top 7p is arranged so that abbreviation contiguity may be carried out at internal-surface of 1s of inner vacant rooms 1w.

[0026] and -- as the description of the invention in this application -- this spiral protruding line 7 -- the pars intermedia M of a before [ from a feed hopper 3 / sending-out opening 1o ], i.e., the spiral convex of the tip of a screw 6, and the back end, -- the height Hm of top 7p of a part which left the 3-4-roll part of 7 is low formed compared with the height Ho of top 7p of the other part. If another word is carried out, the volume of void CLm of top 7p of the spiral protruding line 7 in this pars intermedia M and internal-surface of 1s of inner vacant rooms 1w will be formed so that it may become larger than the volume of void CLo of the other part.

[0027] A setup of the height Hm of top 7p in this pars intermedia M is performed by deleting the spiral protruding line 7 in 20 - 100% of range preferably. Drawing 1 is in the condition which deleted 50% of abbreviation, and drawing 3 is the perspective view showing the appearance configuration of the screw 6 in that case.

[0028] Moreover, drawing 4 shows the case where 100% of deletion is performed, and drawing 5 is the perspective view showing the appearance configuration of the screw 6 in that case. In this case, the side peripheral surface of the screw 6 of pars intermedia M turns into a smooth field.

[0029] Next, in the screw 6, the injection plunger 8 is incorporated free [ sliding ] on the same axle as usual. With the slide drive (illustration abbreviation.), it exposes from the point of a screw 6, and this injection plunger 8 constitutes the inside of said injection cylinder 2 so that attitude migration (arrow head b) may be attained. Furthermore, the check valve 9 for preventing the back flow of the resin at the time of injection is attached in 8t of the point. In addition, since it is the thing of a device usually used generally, this check valve 9 omits explanation of that detailed configuration.

[0030] Moreover, since an above-mentioned rotation drive and an above-mentioned slide drive are already a well-known common drive, the detail is omitted.

[0031]

[An operation of this example] This example acts as follows by this configuration. Since the bus-bar P of 1s of inner vacant rooms formed in the right circular cone configuration and a screw 6 has the fixed tilt angle theta to a revolving shaft C, as shown in a plot of drawing 2, the reaction N perpendicular to wall surface 1w acts as component of a force of the applied force F parallel to the revolving shaft C produced by the rotation of the spiral protruding line 7. A product with the coefficient of friction mu of this reaction N and internal-surface 1w serves as the aforementioned frictional force Tb for a barrel ( $=\mu N$ ).

[0032] In  $>$  (frictional force Tb for barrel) (frictional force Ts for screw) relation which this mentioned above, the frictional force Tb for a barrel is closely related to the theory that it is so good that it is large, and influences the change in the conveyance force of a raw material.

[0033] Here, in the interstitial segment M by which mirror plane finishing of the internal-surface 1w was carried out, it is small, \*\* and the frictional force Tb for a barrel are comparatively small, and coefficient of friction mu is pressed down. Consequently, between a melting (or softening) raw material and internal-surface 1w, a certain amount of slip will arise and the bearer rate of the raw material in this part will become comparatively slower than parts other than an interstitial segment M.

[0034] Moreover, since what (arrow head d) a raw material overcomes these Yamabe 7P, and is moved becomes possible, the raw material conveyed superfluously is put back without getting it blocked, and it



is made for the bearer rate ahead of a raw material to be delayed by the part from which top 7P of the spiral protruding line 7 were deleted as a result.

[0035]

[Other Example(s)] Next, drawing 6 is notch drawing of longitudinal section showing other whole example. This example carries out amount diameter expansion of the pars intermedia M of a before [ from a feed hopper 3 / sending-out opening 1o ] a little among the vacant rooms in said barrel by which it was formed in the right circular cone configuration, and diameter reduction inclination (contraction rate of the diameter on the basis of shaft orientations) was fixed, and forms inside wall 1w. In this example, after expanding gradually the diameter of the bore of 1s of vacant rooms in a barrel whose diameter was reduced at a fixed rate in pars intermedia M from the back end, this diameter expansion section 1k is formed by the configuration which reduces the diameter of gradually and is returned to the original diameter reduction inclination.

[0036] the spiral convex of the screw [ in / by this configuration / pars intermedia M ] 6 -- when the volume of void between 7 and internal-surface 1w spreads from the other part, migration of a melting raw material or the convection current will occur, and conveyance will be delayed as a result.

[0037] In addition, if it constitutes so that the configuration of this diameter expansion section 1k may not be limited to the above-mentioned example (it sets to the longitudinal section and is the shape of a triangle) and the bore of pars intermedia M may carry out amount diameter expansion a little against the fixed diameter reduction inclination of the other part, it is good also as the shape for example, of a hemicycle in addition to the shape of a triangle.

[0038]

[Possibility of other examples] In addition, although the taper angle ( $2\theta$ ) of a right circular cone configuration has set the configuration of the screw 6 which was used in the above-mentioned example and which suits 1s of inner vacant rooms of a barrel 1, and this as one kind, you may make it use the screw form and inner vacant room form which are making indication offer of having combined this taper angle by two or more kinds by the previous application (Japanese Patent Application No. No. 232353 [ seven to ]) made into the contents. Thereby, various raw materials can be made to correspond exactly.

[0039] Moreover, although the above-mentioned example has described the case where the plasticization kneading equipment of the invention in this application is applied to plasticization / injection equipment of an injection molding machine, this application equipment is not limited to this and applying to the extruder of a blow molding machine etc. has the versatility which can apply widely a solid grain-like resin raw material (or resin mixing raw material) to softening and melting, and the equipment that is made to knead and is sent out to the front.

[0040]

[Effect] by the configuration of the above-mentioned invention in this application , by [ of the inside wall of the inner vacant room of a barrel ] consider pars intermedia as mirror plane finishing at least , the excess of conveyance from which the conveyance force had become a problem in the screw of the fully secured cone configuration depending on the class of resin raw material with the minor axis can be cancel , and conveyance of the resin in the condition of having soften or dissolve can be ensure stably .

[0041] Moreover, the torque over (overload) of the screw by raw material plugging of a between [ a screw and internal surfaces ] can be prevented by the excess of conveyance by adjusting the height of the spiral convex crowning of a screw from making the raw material which became soft or dissolved overcome positively, and moving it.

[0042] Furthermore, a part of \*\* can make various resin raw materials (large resin of the viscosity inclination by softening) correspond exactly by combining the all deleted thing of mirror plane finishing of these insides wall, and the spiral convex crowning of a screw.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

DETAILED DESCRIPTION

---

[Detailed Description of the Invention]

[0001]

[Field of the Invention] The invention in this application belongs to the technical field of the plasticization kneading equipment characterized by making into a right circular cone configuration the screw which suits the inner vacant room of a barrel, and this in plasticization, kneading, and conveyance of the molding resin raw material in injection molding, blow formation, or extrusion molding.

[0002]

[The premise of invention, and the technique to the former] As what was used for the injection molding machine among conventional plasticization, kneading, and transport device, the method which incorporated the injection plunger on the same axle in a cylindrical shape-like screw existed (for example, 63 years [ of utility model application public presentation Showa ] No. 189618, patent application public presentation [ Heisei 2 ] No. 164511).

[0003] As this plasticization / injection device 50 was shown in drawing 7 , the mainly following configurations were taken. That is, the barrel 53 of the shape of an inner sky type cylinder to which the outside periphery was equipped with the band-shaped electric heater 51 as a heating means, and the hopper 52 which supplies back a raw material (resin by which solid granulation was carried out) was connected is constituted, and adaptation arrangement of the screw 55 by which the spiral slot 54 was formed in the periphery side face in this barrel 53 is carried out. This screw 55 is constituted by the rotation drive 56 so that axial rotation may be carried out on the same axle of a barrel hollow form.

[0004] Furthermore, as it continues on the same axle, the injection cylinder 57 is arranged at the tip side (anti-hopper 52 side) of a barrel 53, and the nozzle 58 is formed in the point.

[0005] Moreover, on the same axle in a screw 55, the cylinder rod-like injection plunger 59 is incorporated possible [ sliding ], and the point side is constituted so that it may expose from the tip of a screw 55 and may advance or leave into the injection cylinder 57 with a slide drive (illustration abbreviation.) (arrow head c).

[0006] By the above-mentioned configuration, the raw material supplied from the hopper 52 is involved in the spiral slot 54 by the side of the management of a screw 55 one by one, goes, and it is conveyed in the direction of a tip (front), and it goes while carrying out softening melting (plasticization) with the frictional heat by the molecule shear generated by the rotation, and the addition heat from a band-shaped electric heater 51. Thus, the conveyed melting material (raw material) is stored in the injection cylinder 57, and it stops rotation of a screw 55 temporarily and it is made to inject it in a cavity (a molding die, illustration abbreviation.) from a nozzle 58 in the place which reached the specified quantity by work of an injection plunger 59.

[0007] However, by this device, since the screw 55 was cylindrical, in the viscous small resin of oleo resin, a polyamide, BORIBUCHIREN terephthalate, polyethylene terephthalate, etc., the trouble which melting resin races and serves as conveyance impossible (the so-called slip phenomenon) to the front had arisen.

[0008] By the way, in order to secure the conveyance force by rotation of the screw slot in a barrel, it is

> (circumferential direction frictional force of melting material and a barrel inside wall "the pair barrel frictional force  $T_b$ ") (circumferential direction frictional force of melting material and a screw peripheral wall "the pair screw frictional force  $T_s$ ").

It is necessary to be in \*\*\*\*\*, and it can be said that the bigger conveyance force is acquired, so that the frictional force  $T_b$  for a barrel is so good that it is large and the frictional force  $T_s$  for a screw is conversely small.

[0009] With the above-mentioned conventional barrel 53 and the structure of a screw 55, since the operation direction of the conveyance force (force which pushes aside melting material to the front) was parallel to the inside wall of a barrel, the vertical component to a surface wall could not generate it easily. Therefore, the difference was lost to both the actual frictional force  $T_b$  and  $T_s$ , and melting material had changed into the condition of having raced in the same location. If it compares and said, since there would be no force in which the nut screwed in the screw suppresses rotation of the nut, it raced in the location and was like not moving to the front.

[0010] Therefore, although standard tactics finished the barrel inside wall coarsely from this model, conveyance impossible was still produced. As what solves the above-mentioned trouble, an applicant for this patent applies the epoch-making plasticization kneading equipment which made the configuration of the screw which suits and fits into the empty type in a barrel, and this the right circular cone configuration to plasticization / injection device of an injection molding machine, and has already done the offer indication as JP,7-75859,B and Japanese Patent Application No. No. 232353 [ seven to ].

[0011] In addition, in the below-mentioned example, the main configurations of this plasticization / injection device are united and explained, and go.

[0012]

[Problem(s) to be Solved by the Invention] However, although the plasticization kneading equipment of the above-mentioned right circular cone configuration screw canceled effectively the fault of the conveyance impossible which suited the thing of a former straight-rod shaped screw from it From the resin raw material of some classes, the resin (for example, -MMA resin, LCP resin and PBT resin) with which viscosity rises quickly by the softening initial stage The excess of conveyance of a raw material occurred and it was got blocked near the midpoint of a screw in screw Mizouchi, and it became the torque over of a rotation driving gear, and there was a case where ununiformity-izing of the amount of conveyances or destabilization of conveyance time amount occurred.

[0013]

[Objects of the Invention] Then, the invention in this application offers new plasticization kneading equipment aiming at making stable conveyance perform while preventing the excess of conveyance of raw material resin by performing further amelioration paying attention to these inconvenient points, leaving the description which was excellent in this point application.

[0014]

[Means for Solving the Problem] The plasticization kneading equipment concerning the invention in this application is constituted as follows. Namely, the barrel by which the inner vacant room of the right circular cone configuration of tip diameter reduction was formed, and the feed hopper of a raw material was formed in the back end periphery of this inner vacant room, and sending-out opening was formed in the point, While carrying out abbreviation adaptation, fitting in in a vacant room among these barrels and being held free [ axial rotation ] on the same axle The screw of the right circular cone configuration by which the spiral protruding line was formed in the side peripheral surface, and the injection cylinder by which connected with sending-out opening of said barrel on the same axle, and the nozzle was formed in the point, In the becoming plasticization kneading equipment the injection plunger to which it is incorporated possible [ sliding on the same axle in said screw ], and the point carries out attitude migration of the inside of said injection cylinder -- since -- It is characterized by the thing of a before [ from a feed hopper / sending-out opening ] for which pars intermedia was considered as mirror plane finishing at least among the internal surfaces of the inner vacant room of said barrel.

[0015] Or it is characterized by making volume of void of the crowning of said spiral protruding line and the internal surface of an inner vacant room in the pars intermedia of a before [ from the feed hopper

of the vacant room in said barrel / sending-out opening ] larger than the volume of void of the other part.

[0016] Furthermore, it is also possible among the internal surfaces of the inner vacant room of said barrel to make volume of void with the internal surface of the crowning of said spiral protruding line in the pars intermedia of a before [ from the feed hopper of the vacant room in said barrel / sending-out opening ] while considering pars intermedia as mirror plane finishing at least and inner vacant room of a before [ from a feed hopper / sending-out opening ] larger than the volume of void of the other part.

[0017] Or the diameter of the pars intermedia of a before [ from a feed hopper / sending-out opening ] may be made to expand among said vacant room forms in a barrel where it is formed in a right circular cone configuration, and diameter reduction inclination becomes fixed.

[0018]

[Function] The invention in this application is the thing of the inside wall of the inner vacant room of a barrel for which pars intermedia is consider as mirror plane finishing at least , the excess of conveyance from which the conveyance force had become a problem in the screw of the fully secured cone configuration depending on the class of resin raw material with the minor axis is cancel by the above configuration , and conveyance of the resin in the condition of having soften or dissolve is ensure stably .

[0019] Moreover, by [ of a screw / spiral convex ] making the height of the crowning of pars intermedia lower than other parts at least, by taking the gap of a crowning and an internal surface greatly, the raw material which became soft or dissolved is made to be overcome positively, and is moved. Raw material plugging of a between [ the screws and internal surfaces by superfluous conveyance ] is canceled by this, and the torque over (overload) of the screw by this is prevented.

[0020] Furthermore, a part of \*\* will correspond to various resin raw materials (large resin of the viscosity inclination by softening) exactly by [ of mirror plane finishing of these insides wall, and the spiral convex crowning of a screw ] all combining deletion.

[0021]

[Embodiment of the Invention] Next, an example of concrete operation of the invention in this application constituted as mentioned above is explained to a detail based on a drawing. Drawing 1 is notch drawing of longitudinal section showing whole this example, and drawing 2 is drawing of longitudinal section expanding and showing the important section.

[0022] A barrel 1 forms 1s of inner vacant rooms with the cone configuration (another name "a right circular cone configuration") which is the body-of-revolution form whose diameter was reduced by the interior toward the direction of a tip (a drawing top, left-hand side), and connection immobilization of the injection cylinder 2 which is open for free passage with 1s of inner vacant rooms by sending-out opening 1o at the tip is carried out on the same axle. Moreover, the feed hopper 3 for supplying the raw material by which solid granulation was carried out which is open for free passage to 1s of inner vacant rooms, and consists of admixtures, such as resin material, and ceramic powder or metal fine particles, etc. is formed in back end flank of 1s of inner vacant rooms 1b. this feed hopper 3 -- usually -- a funnel - hopper 3h of a \*\* is connected.

[0023] As mentioned above, in order that internal-surface 1w of this barrel 1 may secure the conveyance force, standard tactics are usually finished coarsely, but in the invention in this application, since it is considering as 1s of inner vacant rooms of a cone configuration, the need and sufficient conveyance force are secured from that configuration so that it may mention later. Then, since the chief aim of the invention in this application should be stabilized in this conveyance force, it is to consider finishing of internal-surface 1w as mirror plane finishing against the conventional standard tactics. Although the range considered as this mirror plane finishing is good also as the whole surface of 1s of internal surfaces, while being from a feed hopper 3 to sending-out opening 1o, by this example, pars intermedia M is considered as mirror plane finishing at least. concrete -- the spiral convex of the tip of a screw 6, and the back end -- buffing of the 1s of the internal surfaces corresponding to the part which left the 3-4-roll part of 7 is carried out, and it is made to become less than [ Ra(center line average of roughness height) = 8micrometer ] preferably

[0024] In addition, extent of this mirror plane finishing means it being set up suitably and making a smoother field to the field condition of this pars intermedia M according to the class of resin raw material to be used, as compared with other parts. Moreover, the part which carries out this mirror plane finishing is not limited to pars intermedia M, and combines near a tip or near the back end with 5h of openings from the phrase of "even if few". [ other than pars intermedia M ]

[0025] While forming a screw 6 in 1s of inner vacant rooms of the above-mentioned barrel 1 at the right circular cone configuration which carries out abbreviation adaptation, arranging it to 1s of vacant rooms in a barrel and holding possible [ axial rotation (arrow head a) ], the rotation drive (illustration abbreviation.) is connected with the back end section. Moreover, the spiral protruding line 7 spirally wound toward the tip is formed in a side peripheral surface, and the top 7p is arranged so that abbreviation contiguity may be carried out at internal-surface of 1s of inner vacant rooms 1w.

[0026] and -- as the description of the invention in this application -- this spiral protruding line 7 -- the pars intermedia M of a before [ from a feed hopper 3 / sending-out opening 1o ], i.e., the spiral convex of the tip of a screw 6, and the back end, -- the height Hm of top 7p of a part which left the 3-4-roll part of 7 is low formed compared with the height Ho of top 7p of the other part. If another word is carried out, the volume of void CLm of top 7p of the spiral protruding line 7 in this pars intermedia M and internal-surface of 1s of inner vacant rooms 1w will be formed so that it may become larger than the volume of void CLo of the other part.

[0027] A setup of the height Hm of top 7p in this pars intermedia M is performed by deleting the spiral protruding line 7 in 20 - 100% of range preferably. Drawing 1 is in the condition which deleted 50% of abbreviation, and drawing 3 is the perspective view showing the appearance configuration of the screw 6 in that case.

[0028] Moreover, drawing 4 shows the case where 100% of deletion is performed, and drawing 5 is the perspective view showing the appearance configuration of the screw 6 in that case. In this case, the side peripheral surface of the screw 6 of pars intermedia M turns into a smooth field.

[0029] Next, in the screw 6, the injection plunger 8 is incorporated free [ sliding ] on the same axle as usual. With the slide drive (illustration abbreviation.), it exposes from the point of a screw 6, and this injection plunger 8 constitutes the inside of said injection cylinder 2 so that attitude migration (arrow head b) may be attained. Furthermore, the check valve 9 for preventing the back flow of the resin at the time of injection is attached in 8t of the point. In addition, since it is the thing of a device usually used generally, this check valve 9 omits explanation of that detailed configuration.

[0030] Moreover, since an above-mentioned rotation drive and an above-mentioned slide drive are already a well-known common drive, the detail is omitted.

[0031]

[An operation of this example] This example acts as follows by this configuration. Since the bus-bar P of 1s of inner vacant rooms formed in the right circular cone configuration and a screw 6 has the fixed tilt angle theta to a revolving shaft C, as shown in a plot of drawing 2, the reaction N perpendicular to wall surface 1w acts as component of a force of the applied force F parallel to the revolving shaft C produced by the rotation of the spiral protruding line 7. A product with the coefficient of friction mu of this reaction N and internal-surface 1w serves as the aforementioned frictional force Tb for a barrel ( $=\mu N$ ).

[0032] In > (frictional force Tb for barrel) (frictional force Ts for screw) relation which this mentioned above, the frictional force Tb for a barrel is closely related to the theory that it is so good that it is large, and influences the change in the conveyance force of a raw material.

[0033] Here, in the interstitial segment M by which mirror plane finishing of the internal-surface 1w was carried out, it is small, \*\* and the frictional force Tb for a barrel are comparatively small, and coefficient of friction mu is pressed down. Consequently, between a melting (or softening) raw material and internal-surface 1w, a certain amount of slip will arise and the bearer rate of the raw material in this part will become comparatively slower than parts other than an interstitial segment M.

[0034] Moreover, since what (arrow head d) a raw material overcomes these Yamabe 7P, and is moved becomes possible, the raw material conveyed superfluously is put back without getting it blocked, and it

is made for the bearer rate ahead of a raw material to be delayed by the part from which top 7P of the spiral protruding line 7 were deleted as a result.

[0035]

[Other Example(s)] Next, drawing 6 is notch drawing of longitudinal section showing other whole example. This example carries out amount diameter expansion of the pars intermedia M of a before [ from a feed hopper 3 / sending-out opening 1o ] a little among the vacant rooms in said barrel by which it was formed in the right circular cone configuration, and diameter reduction inclination (contraction rate of the diameter on the basis of shaft orientations) was fixed, and forms inside wall 1w. In this example, after expanding gradually the diameter of the bore of 1s of vacant rooms in a barrel whose diameter was reduced at a fixed rate in pars intermedia M from the back end, this diameter expansion section 1k is formed by the configuration which reduces the diameter of gradually and is returned to the original diameter reduction inclination.

[0036] the spiral convex of the screw [ in / by this configuration / pars intermedia M ] 6 -- when the volume of void between 7 and internal-surface 1w spreads from the other part, migration of a melting raw material or the convection current will occur, and conveyance will be delayed as a result.

[0037] In addition, if it constitutes so that the configuration of this diameter expansion section 1k may not be limited to the above-mentioned example (it sets to the longitudinal section and is the shape of a triangle) and the bore of pars intermedia M may carry out amount diameter expansion a little against the fixed diameter reduction inclination of the other part, it is good also as the shape for example, of a hemicycle in addition to the shape of a triangle.

[0038]

[Possibility of other examples] In addition, although the taper angle (2theta) of a right circular cone configuration has set the configuration of the screw 6 which was used in the above-mentioned example and which suits 1s of inner vacant rooms of a barrel 1, and this as one kind, you may make it use the screw form and inner vacant room form which are making indication offer of having combined this taper angle by two or more kinds by the previous application (Japanese Patent Application No. No. 232353 [ seven to ]) made into the contents. Thereby, various raw materials can be made to correspond exactly.

[0039] Moreover, although the above-mentioned example has described the case where the plasticization kneading equipment of the invention in this application is applied to plasticization / injection equipment of an injection molding machine, this application equipment is not limited to this and applying to the extruder of a blow molding machine etc. has the versatility which can apply widely a solid grain-like resin raw material (or resin mixing raw material) to softening and melting, and the equipment that is made to knead and is sent out to the front.

[0040]

[Effect] by the configuration of the above-mentioned invention in this application , by [ of the inside wall of the inner vacant room of a barrel ] consider pars intermedia as mirror plane finishing at least , the excess of conveyance from which the conveyance force had become a problem in the screw of the fully secured cone configuration depending on the class of resin raw material with the minor axis can be cancel , and conveyance of the resin in the condition of having soften or dissolve can be ensure stably .

[0041] Moreover, the torque over (overload) of the screw by raw material plugging of a between [ a screw and internal surfaces ] can be prevented by the excess of conveyance by adjusting the height of the spiral convex crowning of a screw from making the raw material which became soft or dissolved overcome positively, and moving it.

[0042] Furthermore, a part of \*\* can make various resin raw materials (large resin of the viscosity inclination by softening) correspond exactly by combining the all deleted thing of mirror plane finishing of these insides wall, and the spiral convex crowning of a screw.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

TECHNICAL FIELD

---

[Field of the Invention] The invention in this application belongs to the technical field of the plasticization kneading equipment characterized by making into a right circular cone configuration the screw which suits the inner vacant room of a barrel, and this in plasticization, kneading, and conveyance of the molding resin raw material in injection molding, blow formation, or extrusion molding.

---

[Translation done.]

\* NOTICES \*

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

PRIOR ART

---

[The premise of invention, and the technique to the former] As what was used for the injection molding machine among conventional plasticization, kneading, and transport device, the method which incorporated the injection plunger on the same axle in a cylindrical shape-like screw existed (for example, 63 years [ of utility model application public presentation Showa ] No. 189618, patent application public presentation [ Heisei 2 ] No. 164511).

[0003] As this plasticization / injection device 50 was shown in drawing 7 , the mainly following configurations were taken. That is, the barrel 53 of the shape of an inner sky type cylinder to which the outside periphery was equipped with the band-shaped electric heater 51 as a heating means, and the hopper 52 which supplies back a raw material (resin by which solid granulation was carried out) was connected is constituted, and adaptation arrangement of the screw 55 by which the spiral slot 54 was formed in the periphery side face in this barrel 53 is carried out. This screw 55 is constituted by the rotation drive 56 so that axial rotation may be carried out on the same axle of a barrel hollow form.

[0004] Furthermore, as it continues on the same axle, the injection cylinder 57 is arranged at the tip side (anti-hopper 52 side) of a barrel 53, and the nozzle 58 is formed in the point.

[0005] Moreover, on the same axle in a screw 55, the cylinder rod-like injection plunger 59 is incorporated possible [ sliding ], and the point side is constituted so that it may expose from the tip of a screw 55 and may advance or leave into the injection cylinder 57 with a slide drive (illustration abbreviation.) (arrow head c).

[0006] By the above-mentioned configuration, the raw material supplied from the hopper 52 is involved in the spiral slot 54 by the side of the management of a screw 55 one by one, goes, and it is conveyed in the direction of a tip (front), and it goes while carrying out softening melting (plasticization) with the frictional heat by the molecule shear generated by the rotation, and the addition heat from a band-shaped electric heater 51. Thus, the conveyed melting material (raw material) is stored in the injection cylinder 57, and it stops rotation of a screw 55 temporarily and it is made to inject it in a cavity (a molding die, illustration abbreviation.) from a nozzle 58 in the place which reached the specified quantity by work of an injection plunger 59.

[0007] However, by this device, since the screw 55 was cylindrical, in the viscous small resin of oleo resin, a polyamide, BORIBUCHIREN terephthalate, polyethylene terephthalate, etc., the trouble which melting resin races and serves as conveyance impossible (the so-called slip phenomenon) to the front had arisen.

[0008] By the way, in order to secure the conveyance force by rotation of the screw slot in a barrel, it is > (circumferential direction frictional force of melting material and a barrel inside wall "the pair barrel frictional force Tb") (circumferential direction frictional force of melting material and a screw peripheral wall "the pair screw frictional force Ts").

It is necessary to be in \*\*\*\*\*, and it can be said that the bigger conveyance force is acquired, so that the frictional force Tb for a barrel is so good that it is large and the frictional force Ts for a screw is conversely small.

[0009] With the above-mentioned conventional barrel 53 and the structure of a screw 55, since the



operation direction of the conveyance force (force which pushes aside melting material to the front) was parallel to the inside wall of a barrel, the vertical component to a surface wall could not generate it easily. Therefore, the difference was lost to both the actual frictional force  $T_b$  and  $T_s$ , and melting material had changed into the condition of having raced in the same location. If it compares and said, since there would be no force in which the nut screwed in the screw suppresses rotation of the nut, it raced in the location and was like not moving to the front.

[0010] Therefore, although standard tactics finished the barrel inside wall coarsely from this model, conveyance impossible was still produced. As what solves the above-mentioned trouble, an applicant for this patent applies the epoch-making plasticization kneading equipment which made the configuration of the screw which suits and fits into the empty type in a barrel, and this the right circular cone configuration to plasticization / injection device of an injection molding machine, and has already done the offer indication as JP,7-75859,B and Japanese Patent Application No. No. 232353 [ seven to ].

[0011] In addition, in the below-mentioned example, the main configurations of this plasticization / injection device are united and explained, and go.

---

[Translation done.]

**\* NOTICES \***

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

**EFFECT OF THE INVENTION**

---

[Effect] by the configuration of the above-mentioned invention in this application, by [ of the inside wall of the inner vacant room of a barrel ] consider pars intermedia as mirror plane finishing at least, the excess of conveyance from which the conveyance force had become a problem in the screw of the fully secured cone configuration depending on the class of resin raw material with the minor axis can be cancel, and conveyance of the resin in the condition of having soften or dissolve can be ensure stably. [0041] Moreover, the torque over (overload) of the screw by raw material plugging of a between [ a screw and internal surfaces ] can be prevented by the excess of conveyance by adjusting the height of the spiral convex crowning of a screw from making the raw material which became soft or dissolved overcome positively, and moving it.

[0042] Furthermore, a part of \*\* can make various resin raw materials (large resin of the viscosity inclination by softening) correspond exactly by combining the all deleted thing of mirror plane finishing of these insides wall, and the spiral convex crowning of a screw.

---

[Translation done.]

**\* NOTICES \***

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

**TECHNICAL PROBLEM**

---

[Problem(s) to be Solved by the Invention] However, although the plasticization kneading equipment of the above-mentioned right circular cone configuration screw canceled effectively the fault of the conveyance impossible which suited the thing of a former straight-rod shaped screw from it From the resin raw material of some classes, the resin (for example, -MMA resin, LCP resin and PBT resin) with which viscosity rises quickly by the softening initial stage The excess of conveyance of a raw material occurred and it was got blocked near the midpoint of a screw in screw Mizouchi, and it became the torque over of a rotation driving gear, and there was a case where ununiformity-izing of the amount of conveyances or destabilization of conveyance time amount occurred.

[0013]

[Objects of the Invention] Then, the invention in this application offers new plasticization kneading equipment aiming at making stable conveyance perform while preventing the excess of conveyance of raw material resin by performing further amelioration paying attention to these inconvenient points, leaving the description which was excellent in this point application.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

MEANS

---

[Means for Solving the Problem] The plasticization kneading equipment concerning the invention in this application is constituted as follows. Namely, the barrel by which the inner vacant room of the right circular cone configuration of tip diameter reduction was formed, and the feed hopper of a raw material was formed in the back end periphery of this inner vacant room, and sending-out opening was formed in the point, While carrying out abbreviation adaptation, fitting in in a vacant room among these barrels and being held free [ axial rotation ] on the same axle The screw of the right circular cone configuration by which the spiral protruding line was formed in the side peripheral surface, and the injection cylinder by which connected with sending-out opening of said barrel on the same axle, and the nozzle was formed in the point, In the becoming plasticization kneading equipment the injection plunger to which it is incorporated possible [ sliding on the same axle in said screw ], and the point carries out attitude migration of the inside of said injection cylinder -- since -- It is characterized by the thing of a before [ from a feed hopper / sending-out opening ] for which pars intermedia was considered as mirror plane finishing at least among the internal surfaces of the inner vacant room of said barrel.

[0015] Or it is characterized by making volume of void of the crowning of said spiral protruding line and the internal surface of an inner vacant room in the pars intermedia of a before [ from the feed hopper of the vacant room in said barrel / sending-out opening ] larger than the volume of void of the other part.

[0016] Furthermore, it is also possible among the internal surfaces of the inner vacant room of said barrel to make volume of void with the internal surface of the crowning of said spiral protruding line in the pars intermedia of a before [ from the feed hopper of the vacant room in said barrel / sending-out opening ] while considering pars intermedia as mirror plane finishing at least and inner vacant room of a before [ from a feed hopper / sending-out opening ] larger than the volume of void of the other part.

[0017] Or the diameter of the pars intermedia of a before [ from a feed hopper / sending-out opening ] may be made to expand among said vacant room forms in a barrel where it is formed in a right circular cone configuration, and diameter reduction inclination becomes fixed.

---

[Translation done.]

## \* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

## OPERATION

---

[Function] The invention in this application is the thing of the inside wall of the inner vacant room of a barrel for which pars intermedia is consider as mirror plane finishing at least , the excess of conveyance from which the conveyance force had become a problem in the screw of the fully secured cone configuration depending on the class of resin raw material with the minor axis is cancel by the above configuration , and conveyance of the resin in the condition of having soften or dissolve is ensure stably .

[0019] Moreover, by [ of a screw / spiral convex ] making the height of the crowning of pars intermedia lower than other parts at least, by taking the gap of a crowning and an internal surface greatly, the raw material which became soft or dissolved is made to be overcome positively, and is moved. Raw material plugging of a between [ the screws and internal surfaces by superfluous conveyance ] is canceled by this, and the torque over (overload) of the screw by this is prevented.

[0020] Furthermore, a part of \*\* will correspond to various resin raw materials (large resin of the viscosity inclination by softening) exactly by [ of mirror plane finishing of these insides wall, and the spiral convex crowning of a screw ] all combining deletion.

[0021]

[Embodiment of the Invention] Next, an example of concrete operation of the invention in this application constituted as mentioned above is explained to a detail based on a drawing. Drawing 1 is notch drawing of longitudinal section showing whole this example, and drawing 2 is drawing of longitudinal section expanding and showing the important section.

[0022] A barrel 1 forms 1s of inner vacant rooms with the cone configuration (another name "a right circular cone configuration") which is the body-of-revolution form whose diameter was reduced by the interior toward the direction of a tip (a drawing top, left-hand side), and connection immobilization of the injection cylinder 2 which is open for free passage with 1s of inner vacant rooms by sending-out opening 1o at the tip is carried out on the same axle. Moreover, the feed hopper 3 for supplying the raw material by which solid granulation was carried out which is open for free passage to 1s of inner vacant rooms, and consists of admixtures, such as resin material, and ceramic powder or metal fine particles, etc. is formed in back end flank of 1s of inner vacant rooms 1b. this feed hopper 3 -- usually -- a funnel - - hopper 3h of a \*\* is connected.

[0023] As mentioned above, in order that internal-surface 1w of this barrel 1 may secure the conveyance force, standard tactics are usually finished coarsely, but in the invention in this application, since it is considering as 1s of inner vacant rooms of a cone configuration, the need and sufficient conveyance force are secured from that configuration so that it may mention later. Then, since the chief aim of the invention in this application should be stabilized in this conveyance force, it is to consider finishing of internal-surface 1w as mirror plane finishing against the conventional standard tactics. Although the range considered as this mirror plane finishing is good also as the whole surface of 1s of internal surfaces, while being from a feed hopper 3 to sending-out opening 1o, by this example, pars intermedia M is considered as mirror plane finishing at least. concrete -- the spiral convex of the tip of a screw 6, and the back end -- buffing of the 1s of the internal surfaces corresponding to the part which left the 3-4-

roll part of 7 is carried out, and it is made to become less than [  $Ra(\text{center line average of roughness height}) = 8\text{micrometer}$  ] preferably

[0024] In addition, extent of this mirror plane finishing means it being set up suitably and making a smoother field to the field condition of this pars intermedia M according to the class of resin raw material to be used, as compared with other parts. Moreover, the part which carries out this mirror plane finishing is not limited to pars intermedia M, and combines near a tip or near the back end with 5h of openings from the phrase of "even if few". [ other than pars intermedia M ]

[0025] While forming a screw 6 in 1s of inner vacant rooms of the above-mentioned barrel 1 at the right circular cone configuration which carries out abbreviation adaptation, arranging it to 1s of vacant rooms in a barrel and holding possible [ axial rotation (arrow head a) ], the rotation drive (illustration abbreviation.) is connected with the back end section. Moreover, the spiral protruding line 7 spirally wound toward the tip is formed in a side peripheral surface, and the top 7p is arranged so that abbreviation contiguity may be carried out at internal-surface of 1s of inner vacant rooms 1w.

[0026] and -- as the description of the invention in this application -- this spiral protruding line 7 -- the pars intermedia M of a before [ from a feed hopper 3 / sending-out opening 1o ], i.e., the spiral convex of the tip of a screw 6, and the back end, -- the height  $H_m$  of top 7p of a part which left the 3-4-roll part of 7 is low formed compared with the height  $H_o$  of top 7p of the other part. If another word is carried out, the volume of void  $CL_m$  of top 7p of the spiral protruding line 7 in this pars intermedia M and internal-surface of 1s of inner vacant rooms 1w will be formed so that it may become larger than the volume of void  $CL_o$  of the other part.

[0027] A setup of the height  $H_m$  of top 7p in this pars intermedia M is performed by deleting the spiral protruding line 7 in 20 - 100% of range preferably. Drawing 1 is in the condition which deleted 50% of abbreviation, and drawing 3 is the perspective view showing the appearance configuration of the screw 6 in that case.

[0028] Moreover, drawing 4 shows the case where 100% of deletion is performed, and drawing 5 is the perspective view showing the appearance configuration of the screw 6 in that case. In this case, the side peripheral surface of the screw 6 of pars intermedia M turns into a smooth field.

[0029] Next, in the screw 6, the injection plunger 8 is incorporated free [ sliding ] on the same axle as usual. With the slide drive (illustration abbreviation.), it exposes from the point of a screw 6, and this injection plunger 8 constitutes the inside of said injection cylinder 2 so that attitude migration (arrow head b) may be attained. Furthermore, the check valve 9 for preventing the back flow of the resin at the time of injection is attached in 8t of the point. In addition, since it is the thing of a device usually used generally, this check valve 9 omits explanation of that detailed configuration.

[0030] Moreover, since an above-mentioned rotation drive and an above-mentioned slide drive are already a well-known common drive, the detail is omitted.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

EXAMPLE

---

[Other Example(s)] Next, drawing 6 is notch drawing of longitudinal section showing other whole example. This example carries out amount diameter expansion of the pars intermedia M of a before [ from a feed hopper 3 / sending-out opening 1o ] a little among the vacant rooms in said barrel by which it was formed in the right circular cone configuration, and diameter reduction inclination (contraction rate of the diameter on the basis of shaft orientations) was fixed, and forms inside wall 1w. In this example, after expanding gradually the diameter of the bore of 1s of vacant rooms in a barrel whose diameter was reduced at a fixed rate in pars intermedia M from the back end, this diameter expansion section 1k is formed by the configuration which reduces the diameter of gradually and is returned to the original diameter reduction inclination.

[0036] the spiral convex of the screw [ in / by this configuration / pars intermedia M ] 6 -- when the volume of void between 7 and internal-surface 1w spreads from the other part, migration of a melting raw material or the convection current will occur, and conveyance will be delayed as a result.

[0037] In addition, if it constitutes so that the configuration of this diameter expansion section 1k may not be limited to the above-mentioned example (it sets to the longitudinal section and is the shape of a triangle) and the bore of pars intermedia M may carry out amount diameter expansion a little against the fixed diameter reduction inclination of the other part, it is good also as the shape for example, of a hemicycle in addition to the shape of a triangle.

[0038]

[Possibility of other examples] In addition, although the taper angle ( $2\theta$ ) of a right circular cone configuration has set the configuration of the screw 6 which was used in the above-mentioned example and which suits 1s of inner vacant rooms of a barrel 1, and this as one kind, you may make it use the screw form and inner vacant room form which are making indication offer of having combined this taper angle by two or more kinds by the previous application (Japanese Patent Application No. No. 232353 [ seven to ]) made into the contents. Thereby, various raw materials can be made to correspond exactly.

[0039] Moreover, although the above-mentioned example has described the case where the plasticization kneading equipment of the invention in this application is applied to plasticization / injection equipment of an injection molding machine, this application equipment is not limited to this and applying to the extruder of a blow molding machine etc. has the versatility which can apply widely a solid grain-like resin raw material (or resin mixing raw material) to softening and melting, and the equipment that is made to knead and is sent out to the front.

---

[Translation done.]

**\* NOTICES \***

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

**DESCRIPTION OF DRAWINGS**

---

[Brief Description of the Drawings]

[Drawing 1] It is notch drawing of longitudinal section showing whole this example.

[Drawing 2] It is drawing of longitudinal section expanding and showing the important section of this example.

[Drawing 3] It is the perspective view showing the appearance configuration of the screw of this example.

[Drawing 4] It is notch drawing of longitudinal section showing other whole example.

[Drawing 5] It is the perspective view showing the appearance configuration of the screw of other examples.

[Drawing 6] It is notch drawing of longitudinal section showing other whole example.

[Drawing 7] It is notch drawing of longitudinal section showing the conventional example.

[Description of Notations]

- 1 .. Barrel
- 2 .. Injection cylinder
- 3 .. Feed hopper
- 4 .. Nozzle
- 5 .. Metal mold
- 6 .. Screw
- 7 .. Spiral protruding line
- 8 .. Injection plunger
- M .. Pars intermedia (- of a screw)
- Hm .. Height (- of the crowning of pars intermedia)
- Ho .. Height (- of crownings other than pars intermedia)
- CLm .. Volume of void (- of pars intermedia)
- CLo .. Volume of void (- other than pars intermedia)
- C .. Revolving shaft (- of a screw)
- P .. Bus-bar (- of an inner vacant room)

---

[Translation done.]



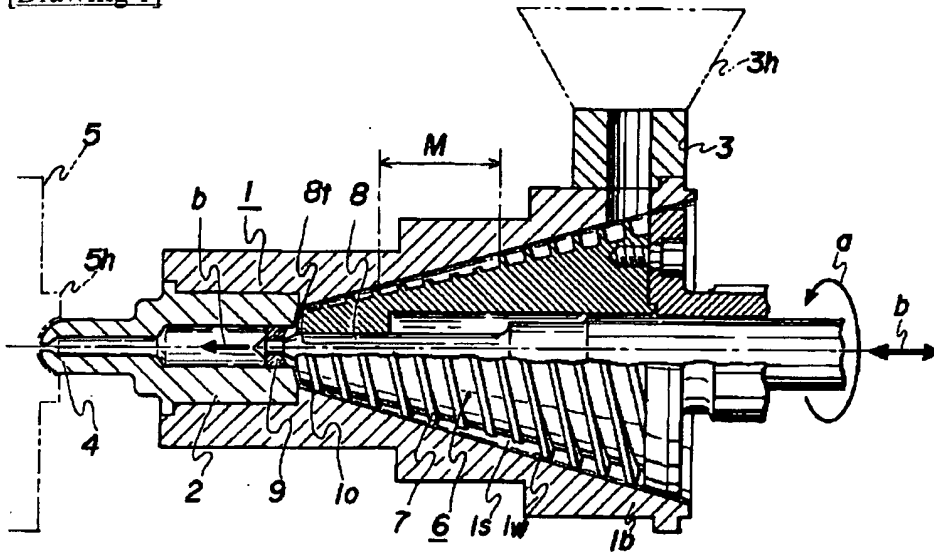
## \* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

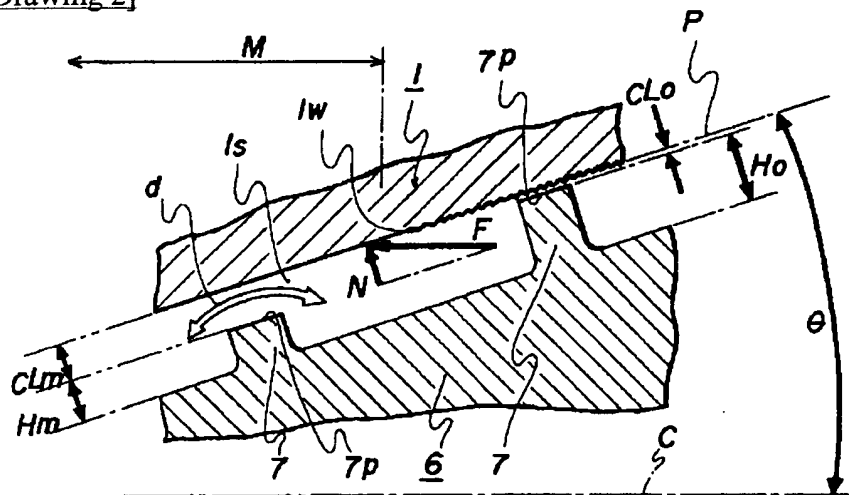
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

## DRAWINGS

[Drawing 1]

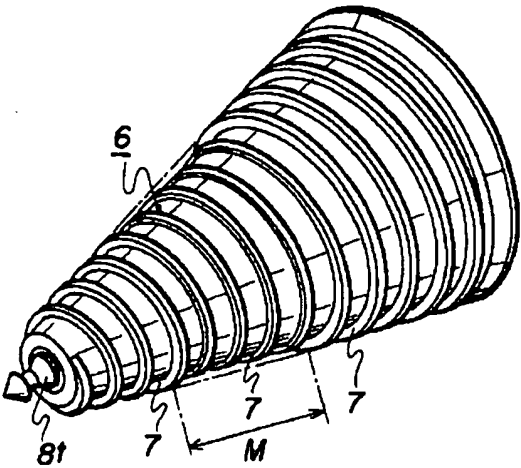


[Drawing 2]

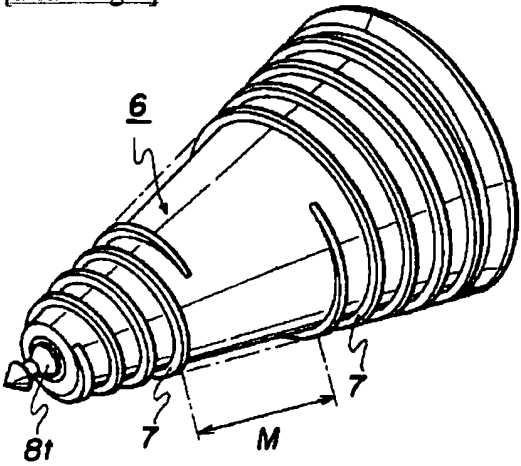


[Drawing 3]

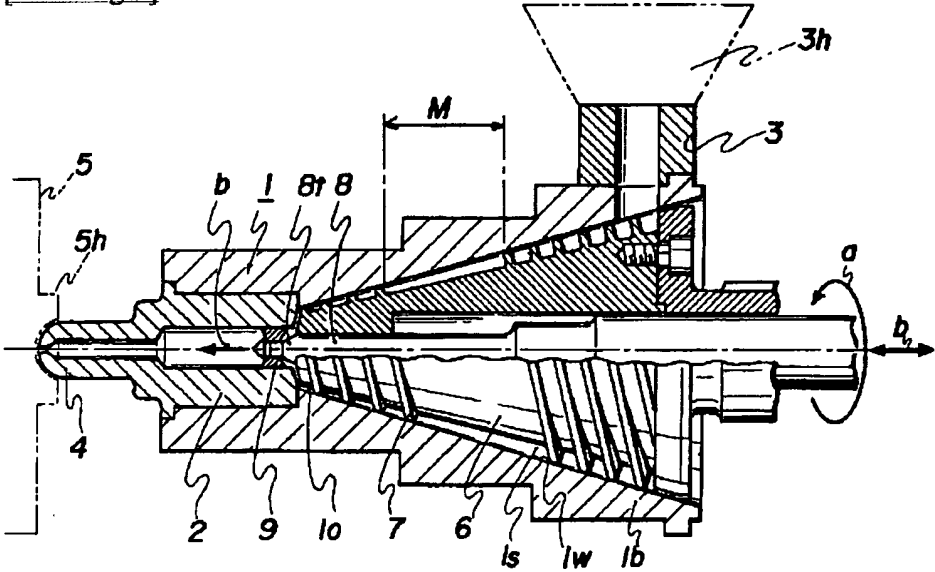
BEST AVAILABLE COPY



[Drawing 5]

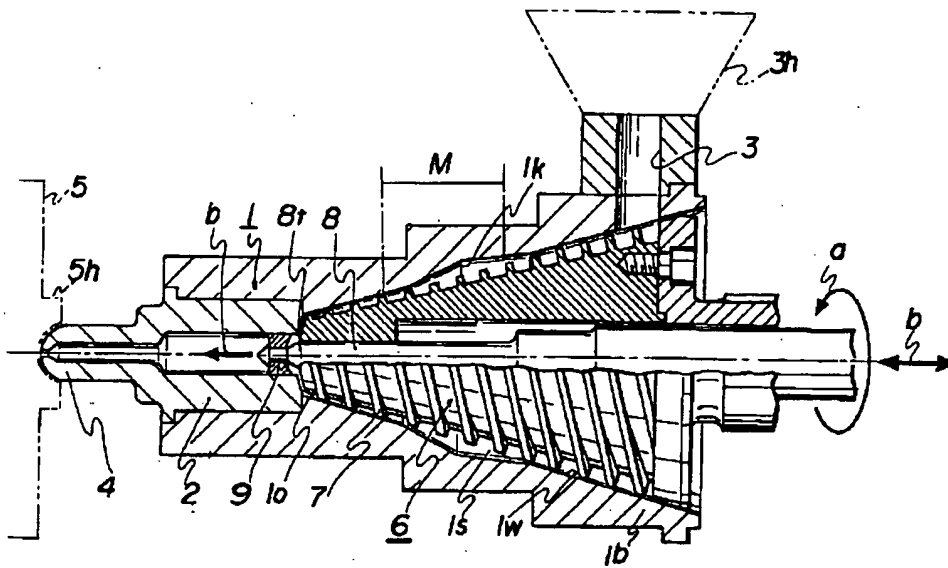


[Drawing 4]

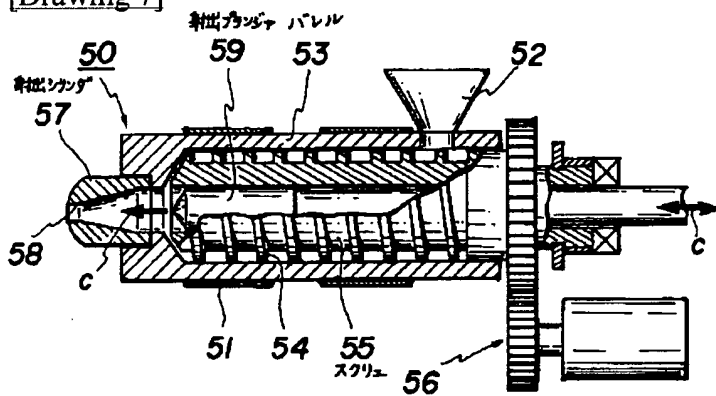


[Drawing 6]

BEST AVAILABLE COPY



[Drawing 7]



[Translation done.]

BEST AVAILABLE COPY